

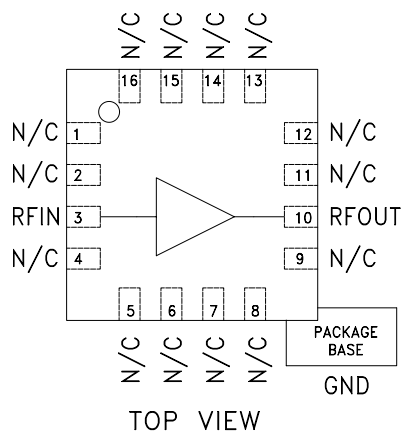
## InGaP HBT GAIN BLOCK MMIC AMPLIFIER, DC - 6.0 GHz

### Typical Applications

The HMC311LP3 is an ideal RF/IF gain block or LO buffer amplifier for:

- Cellular / PCS / 3G
- Fixed Wireless & WLAN
- CATV & Cable Modem
- Microwave Radio

### Functional Diagram



### Features

P1dB Output Power: +15.5 dBm

Output IP3: +32 dBm

Gain: 14.5 dB

50 Ohm I/O's

3 x 3 x 1 mm QFN SMT Package

### General Description

The HMC311LP3 is a GaAs InGaP Heterojunction Bipolar Transistor (HBT) Gain Block MMIC SMT DC to 6 GHz amplifier. This 3x3mm QFN packaged amplifier can be used as either a cascadable 50 Ohm gain stage or to drive the LO of HMC mixers with up to +17 dBm output power. The HMC311LP3 offers 14.5 dB of gain and an output IP3 of +30 dBm while requiring only 56 mA from a +5V supply. The Darlington feedback pair used results in reduced sensitivity to normal process variations and yields excellent gain stability over temperature while requiring a minimal number of external bias components.

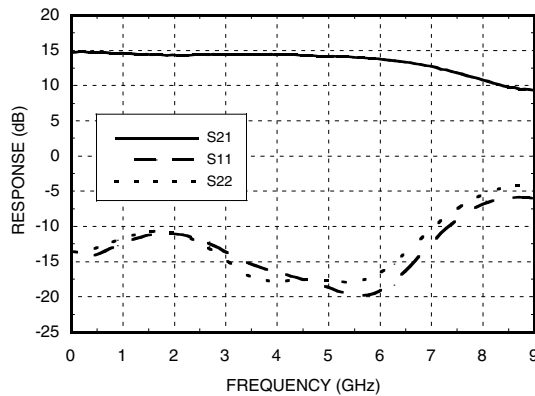
### Electrical Specifications, $V_s = 5.0\text{ V}$ , $R_{bias} = 22\text{ Ohm}$ , $T_A = +25^\circ\text{ C}$

| Parameter                                |               | Min. | Typ.  | Max.  | Units  |
|------------------------------------------|---------------|------|-------|-------|--------|
| Gain                                     | DC - 1.0 GHz  | 13.0 | 14.5  |       | dB     |
|                                          | 1.0 - 4.0 GHz | 12.5 | 14.3  |       | dB     |
|                                          | 4.0 - 6.0 GHz | 12.0 | 14.0  |       | dB     |
| Gain Variation Over Temperature          | DC - 2.0 GHz  |      | 0.005 | 0.008 | dB/ °C |
|                                          | 2.0 - 4.0 GHz |      | 0.008 | 0.012 | dB/ °C |
|                                          | 4.0 - 6.0 GHz |      | 0.012 | 0.016 | dB/ °C |
| Return Loss Input / Output               | DC - 1.0 GHz  |      | 13    |       | dB     |
|                                          | 1.0 - 3.0 GHz |      | 11    |       | dB     |
|                                          | 3.0 - 6.0 GHz |      | 15    |       | dB     |
| Reverse Isolation                        | DC - 6.0 GHz  |      | 18    |       | dB     |
| Output Power for 1 dB Compression (P1dB) | DC - 2.0 GHz  | 13.5 | 15.5  |       | dBm    |
|                                          | 2.0 - 4.0 GHz | 12.0 | 15.0  |       | dBm    |
|                                          | 4.0 - 6.0 GHz | 10.0 | 13.0  |       | dBm    |
| Output Third Order Intercept (IP3)       | DC - 1.0 GHz  |      | 32    |       | dBm    |
|                                          | 1.0 - 2.0 GHz |      | 30    |       | dBm    |
|                                          | 2.0 - 4.0 GHz |      | 28    |       | dBm    |
|                                          | 4.0 - 6.0 GHz |      | 24    |       | dBm    |
| Noise Figure                             | DC - 6.0 GHz  |      | 4.5   |       | dB     |
| Supply Current (Icq)                     |               |      | 56    |       | mA     |

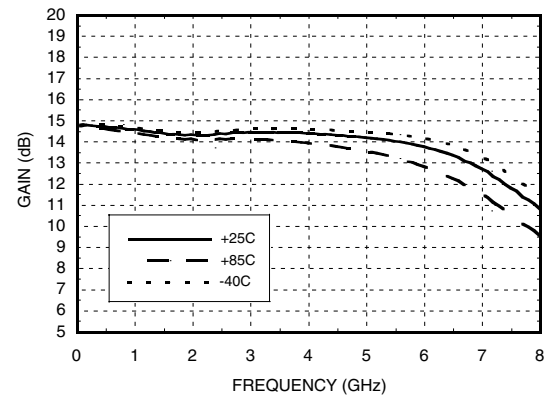
Note: Data taken with broadband bias tee on device output.

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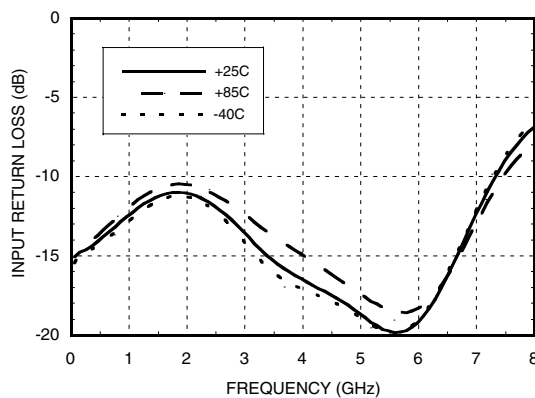
**Gain & Return Loss**



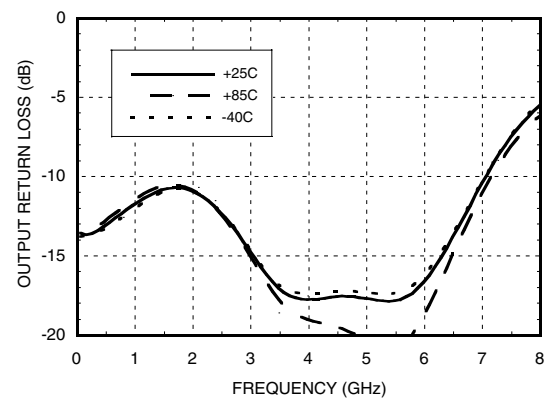
**Gain vs. Temperature**



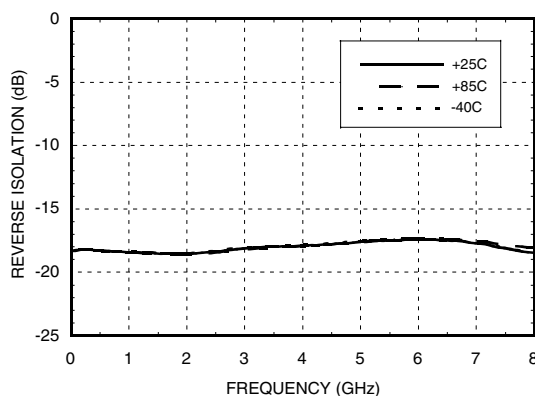
**Input Return Loss vs. Temperature**



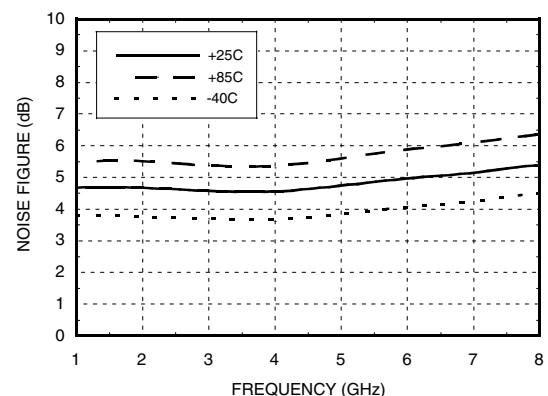
**Output Return Loss vs. Temperature**



**Reverse Isolation vs. Temperature**



**Noise Figure vs. Temperature**

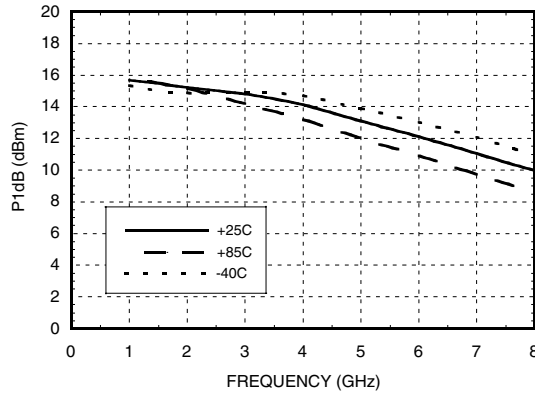


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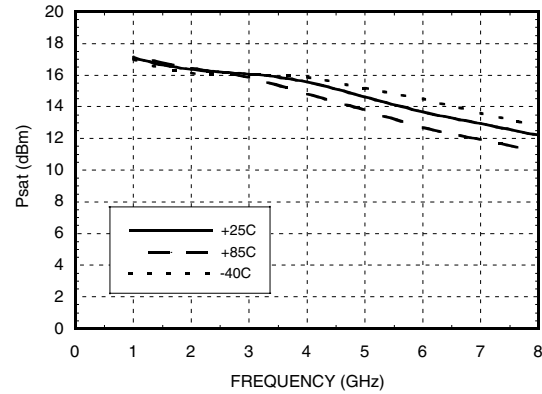
8

AMPLIFIERS - SMT

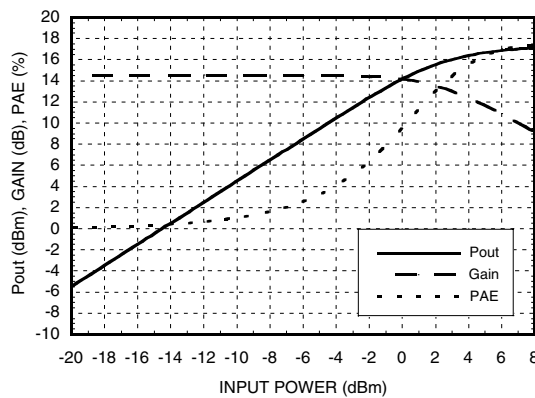
**P1dB vs. Temperature**



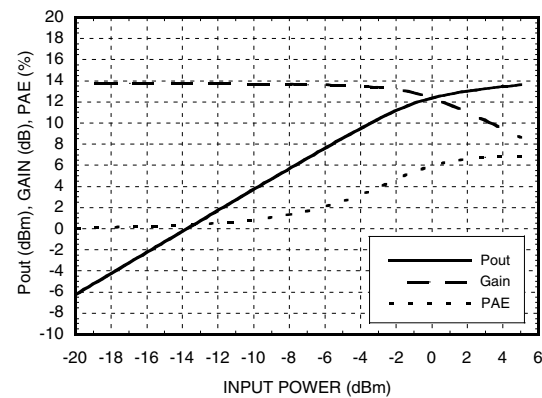
**Psat vs. Temperature**



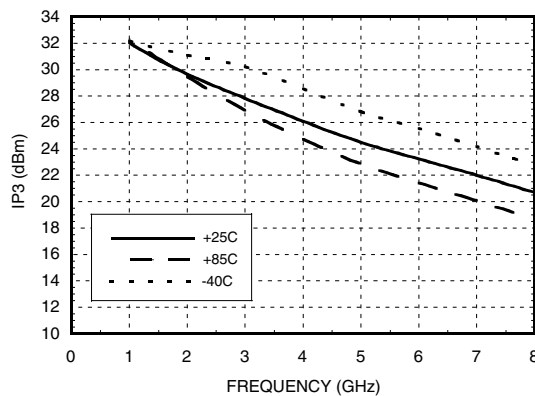
**Power Compression @ 1 GHz**



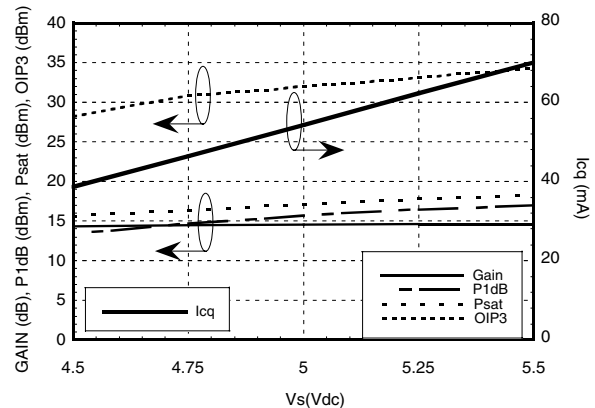
**Power Compression @ 6 GHz**



**Output IP3 vs. Temperature**



**Gain, Power, OIP3 & Supply Current vs. Supply Voltage @ 1 GHz**

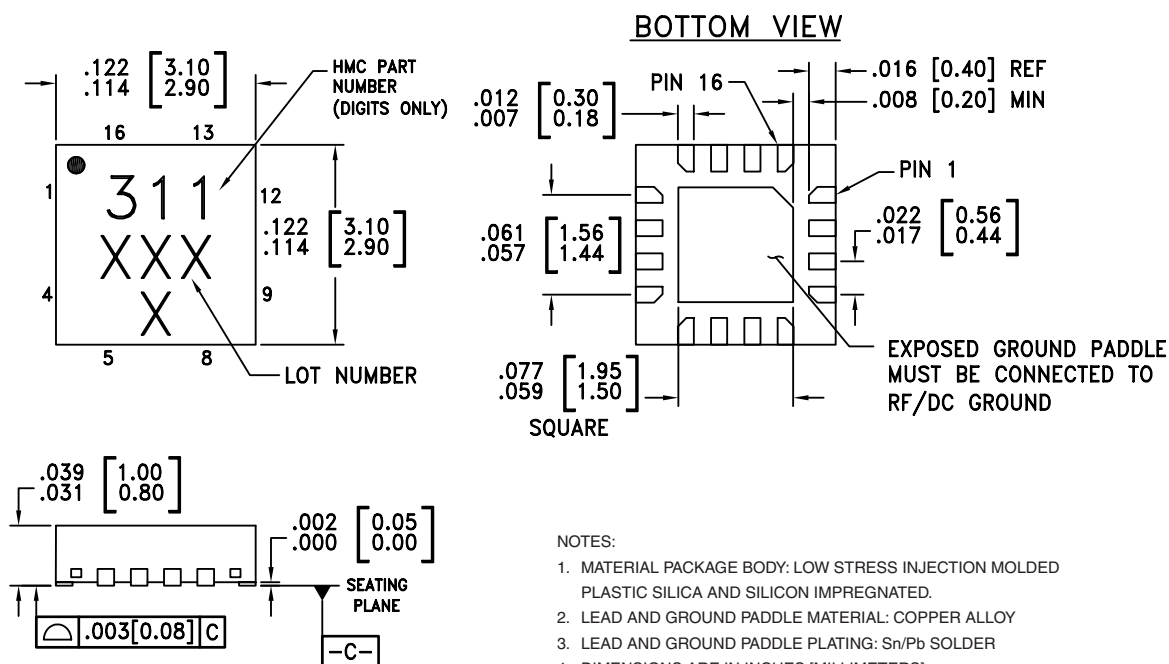


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### Absolute Maximum Ratings

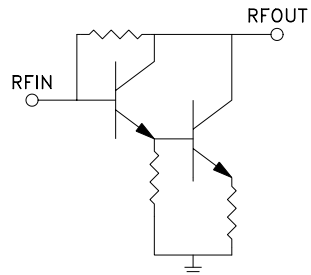
|                                                                 |                |
|-----------------------------------------------------------------|----------------|
| Collector Bias Voltage (Vcc)                                    | +7.0 Vdc       |
| RF Input Power (RFIn)(Vs = +5.0 Vdc)                            | +10 dBm        |
| Junction Temperature                                            | 150 °C         |
| Continuous Pdiss (T = 85 °C)<br>(derate 5.21 mW/°C above 85 °C) | 0.339 W        |
| Thermal Resistance<br>(junction to ground paddle)               | 192 °C/W       |
| Storage Temperature                                             | -65 to +150 °C |
| Operating Temperature                                           | -40 to +85 °C  |

### Outline Drawing

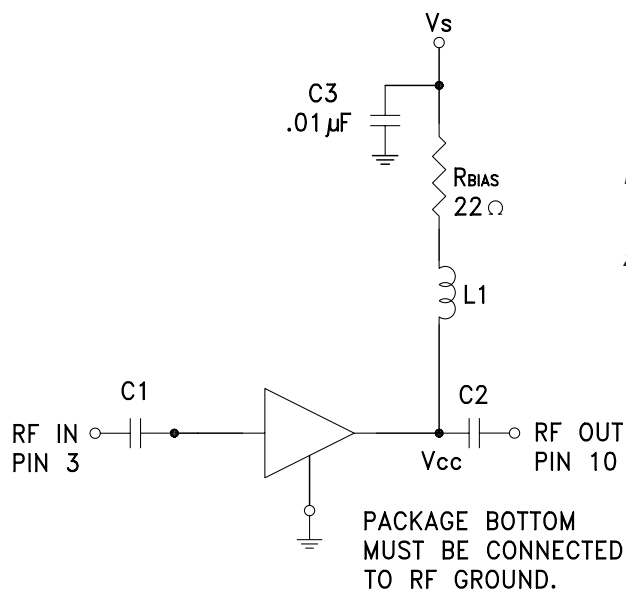


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## Pin Descriptions

| Pin Number              | Function | Description                                                               | Interface Schematic                                                                 |
|-------------------------|----------|---------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 1, 2, 4 - 9,<br>11 - 16 | N/C      | This pin may be connected to RF ground.                                   |                                                                                     |
| 3                       | RFIN     | This pin is DC coupled.<br>An off chip DC blocking capacitor is required. |  |
| 10                      | RFOUT    | RF output and DC Bias for the output stage.                               |                                                                                     |
|                         | GND      | Package bottom must be connected to RF/DC ground.                         |  |

## Application Circuit



Note:

1. Select  $R_{bias}$  to achieve  $I_{cq}$  using equation below,  
 $R_{bias} \geq 22 \text{ Ohm}$ .
2. External blocking capacitors are required on  
RFIN and RFOUT.

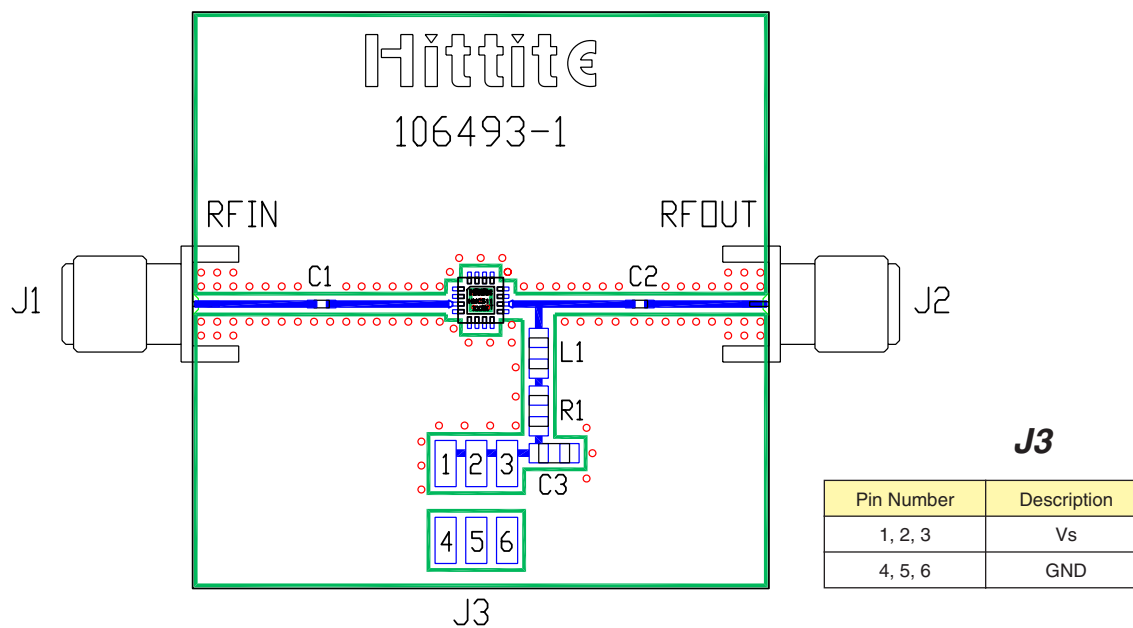
$$I_{cq} = \frac{V_s - 3.9}{R_{bias}}$$

## Recommended Component Values

| Component | Frequency (MHz) |        |        |        |        |        |        |        |
|-----------|-----------------|--------|--------|--------|--------|--------|--------|--------|
|           | 50              | 900    | 1900   | 2200   | 2400   | 3500   | 5200   | 5800   |
| L1        | 270 nH          | 56 nH  | 18 nH  | 18 nH  | 15 nH  | 8.2 nH | 3.3 nH | 3.3 nH |
| C1, C2    | 0.01 $\mu$ F    | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF | 100 pF |

## InGaP HBT GAIN BLOCK MMIC AMPLIFIER, DC - 6.0 GHz

### Evaluation PCB



### List of Materials

| Item                                  | Description                    |
|---------------------------------------|--------------------------------|
| J1 - J2                               | PC Mount SMA Connector         |
| J3                                    | 2 mm DC Header                 |
| C1, C2                                | Capacitor, 0402 Pkg.           |
| C3                                    | 10,000 pF Capacitor, 0805 Pkg. |
| R1                                    | 22 Ohm Resistor, 0805 Pkg.     |
| L1                                    | Inductor, 0805 Pkg.            |
| U1                                    | HMC311LP3                      |
| PCB*                                  | 106493 Evaluation PCB          |
| * Circuit Board Material: Rogers 4350 |                                |

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the package ground leads and exposed paddle should be connected directly to the ground plane similar to that shown. A sufficient number of VIA holes should be used to connect the top and bottom ground planes. The evaluation board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.